



# Strengthening Manufacturing Competitiveness

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# Our Thesis

- ◆ **U.S. losing manufacturing leadership position**
- ◆ **Manufacturing competitiveness requires innovation**
- ◆ **Current U.S. structures are not effective at maturing, commercializing, and broadly disseminating world-leading technologies to U.S. manufacturers**
- ◆ **A new U.S. innovation infrastructure is needed to bridge the gap between basic research and best practice outreach programs**
- ◆ **Other countries have made investments in such an infrastructure. We should learn from these and create a unique model which leverages our strengths**

# Status of U.S. Manufacturing

## ◆ Positives

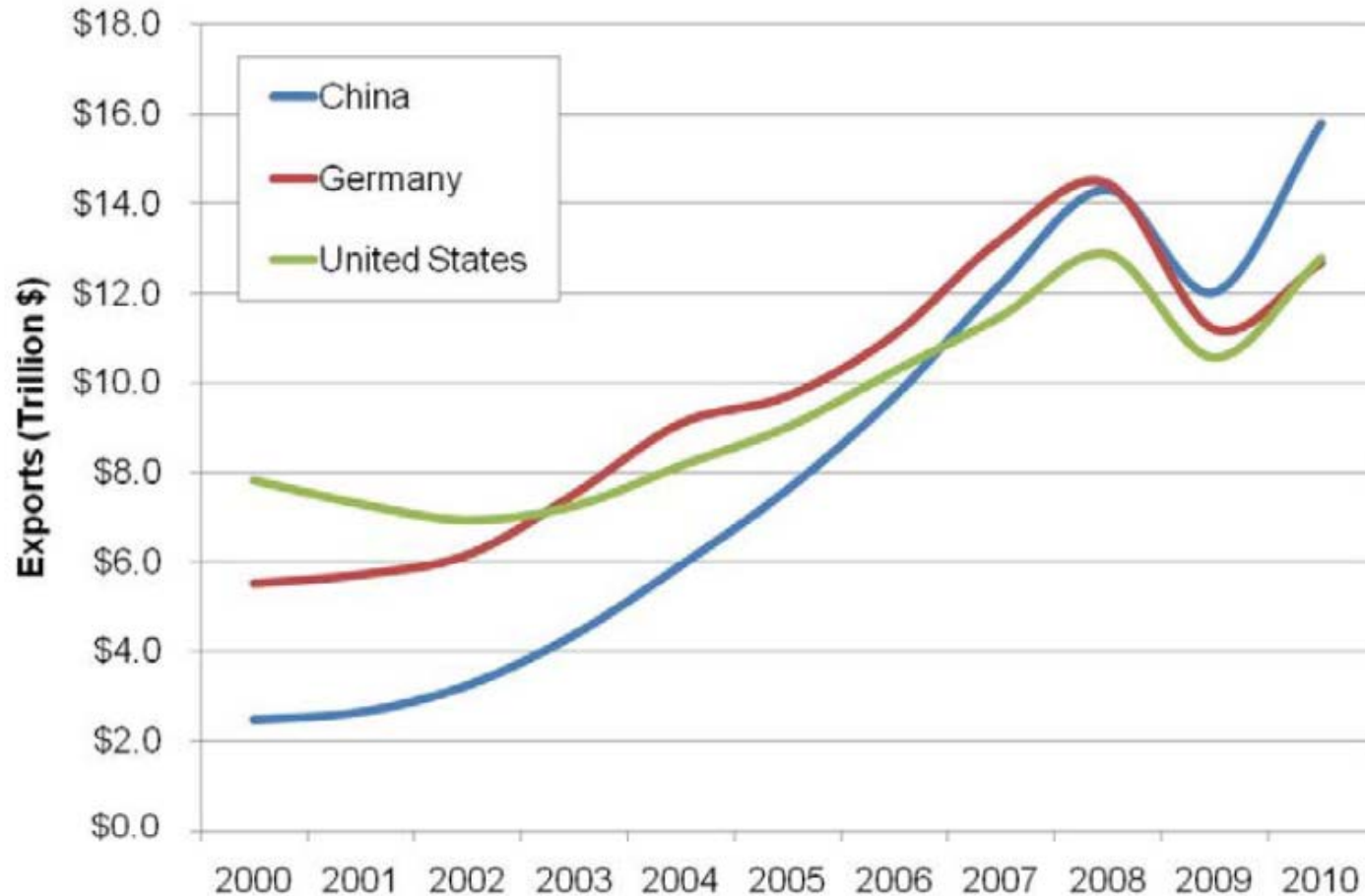
- U.S. still leads global manufacturing output
- If U.S. Manufacturing were a country, it would be the world's eighth largest economy
- Created 230,000 jobs in the first nine months of 2011
- Highest multiplier effect among the major sectors, with every dollar in final sales supporting \$1.40 in output from other sectors

## ◆ Negatives

- Dominant position has steadily eroded over the past decade
- Lost 2.1 million manufacturing jobs during the recession
- Over half of 360 manufacturing executives surveyed see U.S. manufacturing modestly or strongly declining

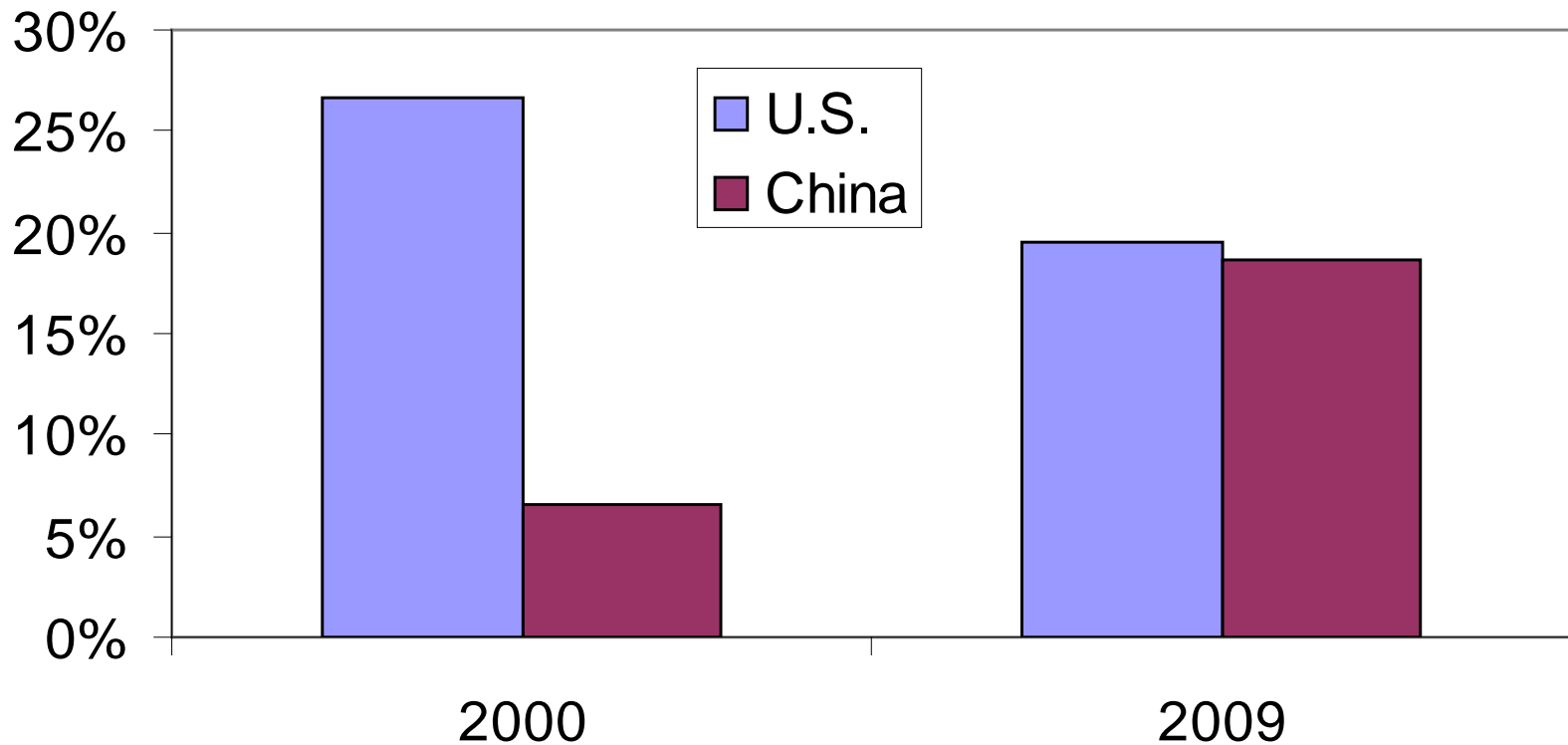
# Global Competitiveness Challenge

## Total Exports



# Global Competitiveness Challenge

**The United States has led in share of Global Manufacturing Output since 1895, until now...**



# Not Just About Low Wages

Growing at nearly 10 percent per year, China's productivity could reach 40 percent of U.S. productivity by 2015

Chinese productivity relative to U.S. productivity (%)



source: Boston Consulting Group report "Made in America Again", Aug 2011

# 2010 Leadership Conference



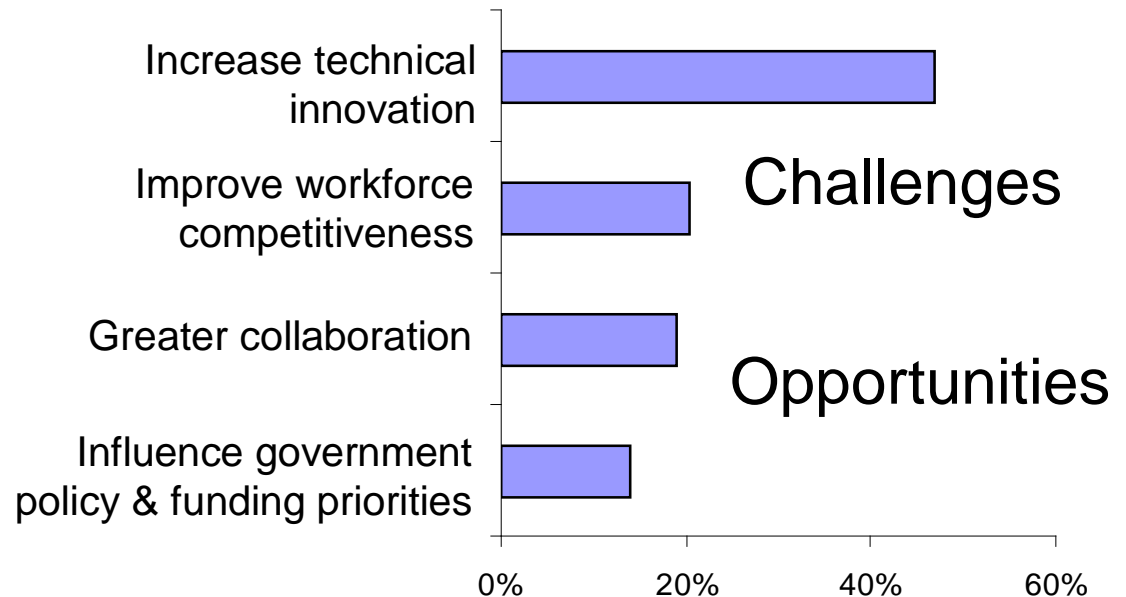

- ◆ **Goal: explore collaborations to advance North America's competitive position**
- ◆ **70 invitees from industry, government, national labs, universities, non-profits**
- ◆ **Identified "grand challenges"**
- ◆ **Discussed opportunities to address the challenges**
- ◆ **High sense of urgency**
- ◆ **Leadership needed from national organizations**

# Priorities to Improve Manufacturing Competitiveness



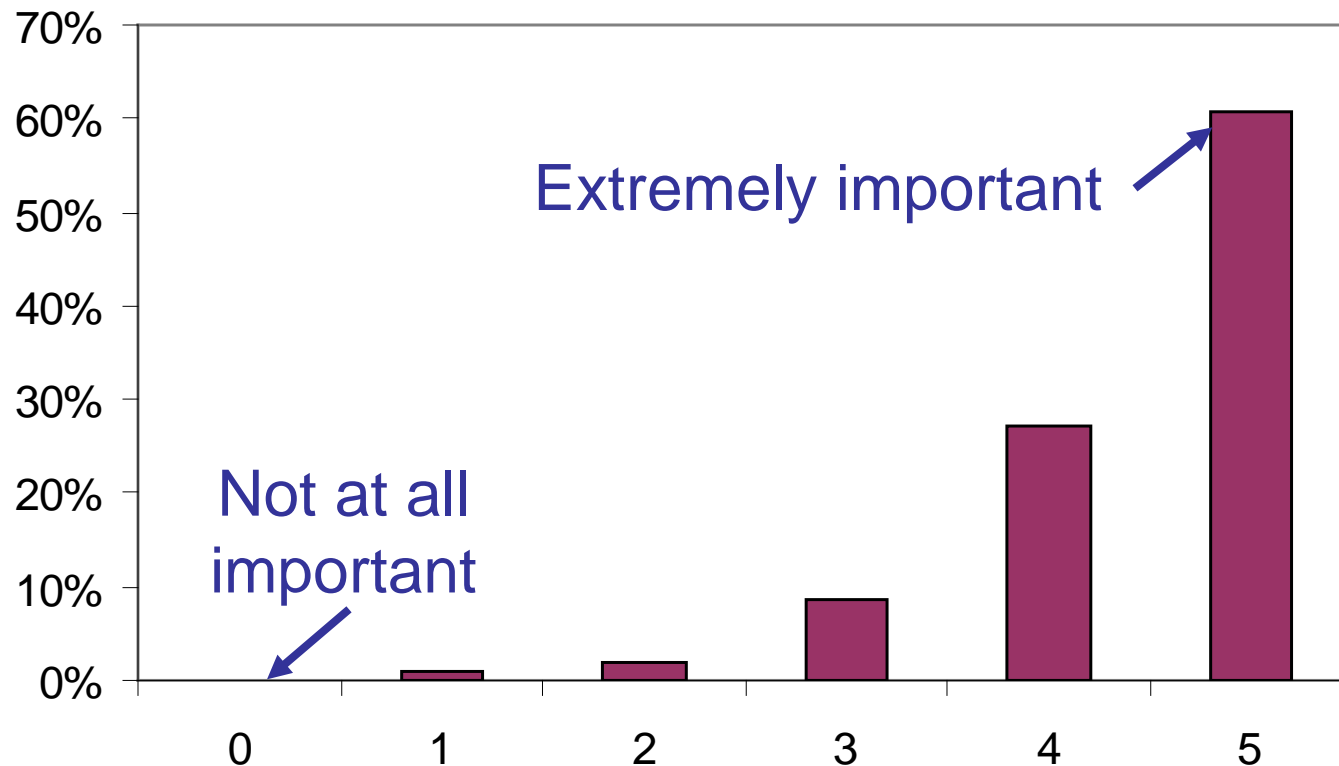
**Strengthening Manufacturing Competitiveness:**  
Report from the 2010 Conference on the Future of Materials Joining in North America

February 2, 2011



# Manufacturers Recognize the Importance of Innovation to Competitiveness

*How important will having world-class manufacturing technologies be to your company's overall competitiveness in the next 5 years?*



# Importance of Innovation to Competitiveness Widely Recognized

- ◆ **June 2010 Global Manufacturing Competitiveness Index**
  - Global survey of 400 manufacturing executives found the number one driver of manufacturing competitiveness to be “talent-driven innovation”
- ◆ **February 2011 President’s State of the Union Message**
  - “We need to out-innovate, out-educate and out-build the rest of the world”
- ◆ **June 2011 President’s Council of Advisors on Science and Technology (PCAST) report:**
  - The country needs “a fertile environment for innovation” to remain a global leader
- ◆ **October 2011 Economist Intelligence Unit Survey of senior executives from U.S. manufacturing firms**
  - 90% identify innovation as the key to long-term success

# EWI uses Surveys and Focus Groups to Assess Emerging Needs

**Example Question: What will be your most important materials-joining related business challenges in the next five years?**

Overall Rank	Challenge	Automotive	Oil & Gas	Defense	Aerospace	Heavy Man	Advanced Energy
1	Increased use of new materials or material combinations	1	4	3	4	4	1
2	Qualifying new processes and procedures			2	1		
3	Maturing and successfully transitioning technologies from R&D to production			1	3		4
4	Keeping staff current on the latest materials joining processes and methods	2					3
5	Shortage of engineers and designers with materials joining expertise		1	4			
6	Increased joint performance requirements	4	2			2	
7	Competition from low labor-cost countries	3					
8	Cost to introduce new processes, procedures, or product designs				2		2
9	First-time quality expectations are increasing					3	
10	Shortage of skilled welders and other skilled trades		3			1	

(Source: 2010 EWI Member Survey~550 responses)

# Commonly Cited Needs

- ◆ **Quality:** More accurate, reliable, and portable NDE. Real-time process monitoring and control.
- ◆ **Materials:** Joining / repair of dissimilar, non-traditional, and advanced materials
- ◆ **Workforce:** Shortage of engineers and skilled trades; attracting talent; keeping skills current
- ◆ **Advanced Processes:** New processes or hybridized processes for demanding applications; and improved process optimization methods
- ◆ **Automation:** Improved process controls; and more flexible automation to maximize productivity and quality.
- ◆ **Modeling:** Improved modeling tools to allow material and process interactions to be simulated in a 3D structure.

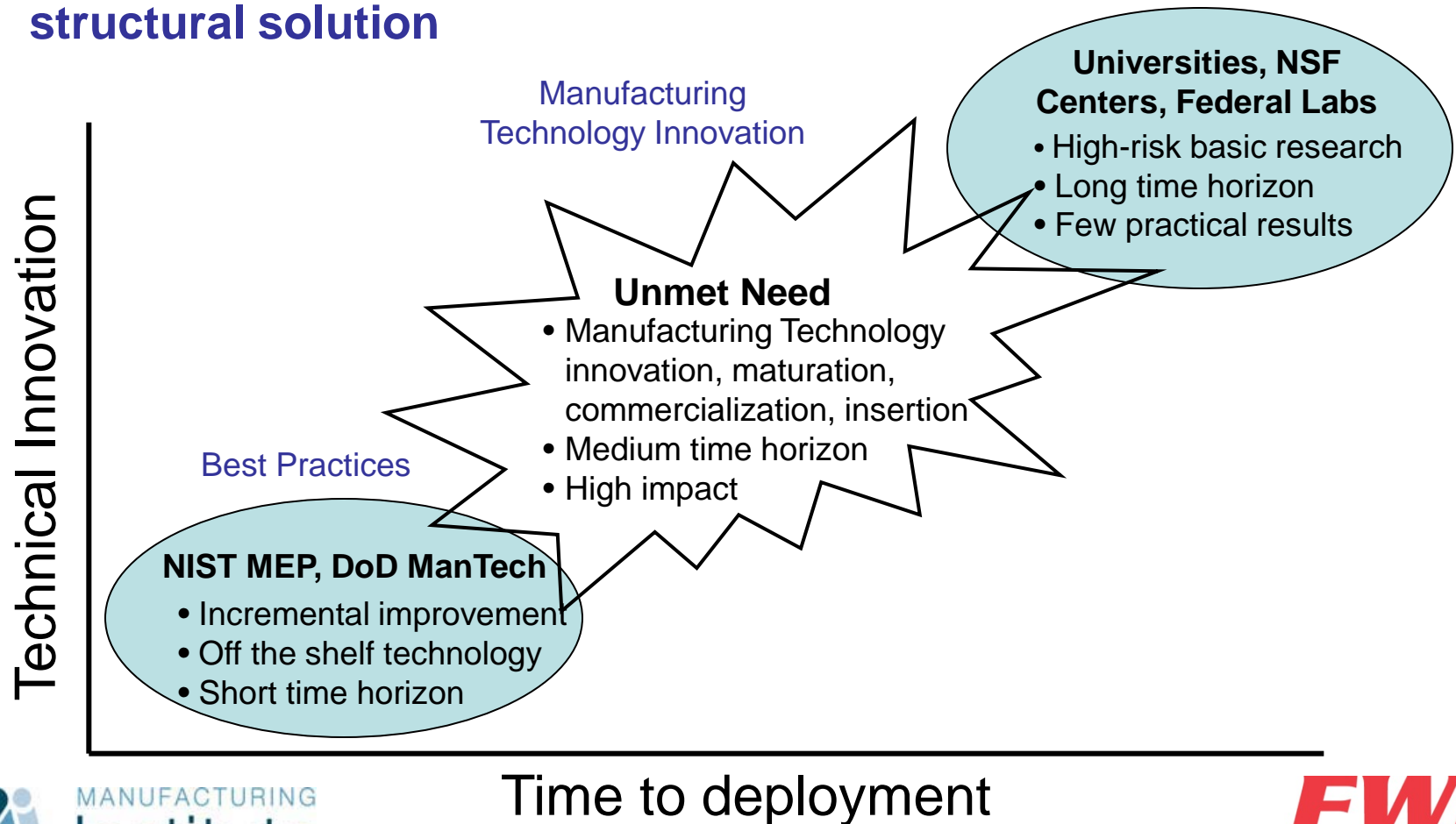
# Cross-Cutting Challenges

- ◆ **Codes, standards, regulations:** Harmonize industry standards to reduce unnecessary variations in requirements. Update standards more quickly to changes in technology. More quantitative criteria and certification systems needed to reduce subjectivity.
- ◆ **Technology proliferation:** Keep up with technology. Share materials joining knowledge so more effective decisions can be made based on cost and performance
- ◆ **Technology maturation/transition:** Better ways to mature and transition technologies from R&D to production; bridge “valley of death” in commercialization

# US Innovation Gap: Little Emphasis on Maturing New Manufacturing Technology

**Structural problem requires a structural solution**

Basic Research / Education



# Global Manufacturing Innovation

## ◆ **Current US innovation model**

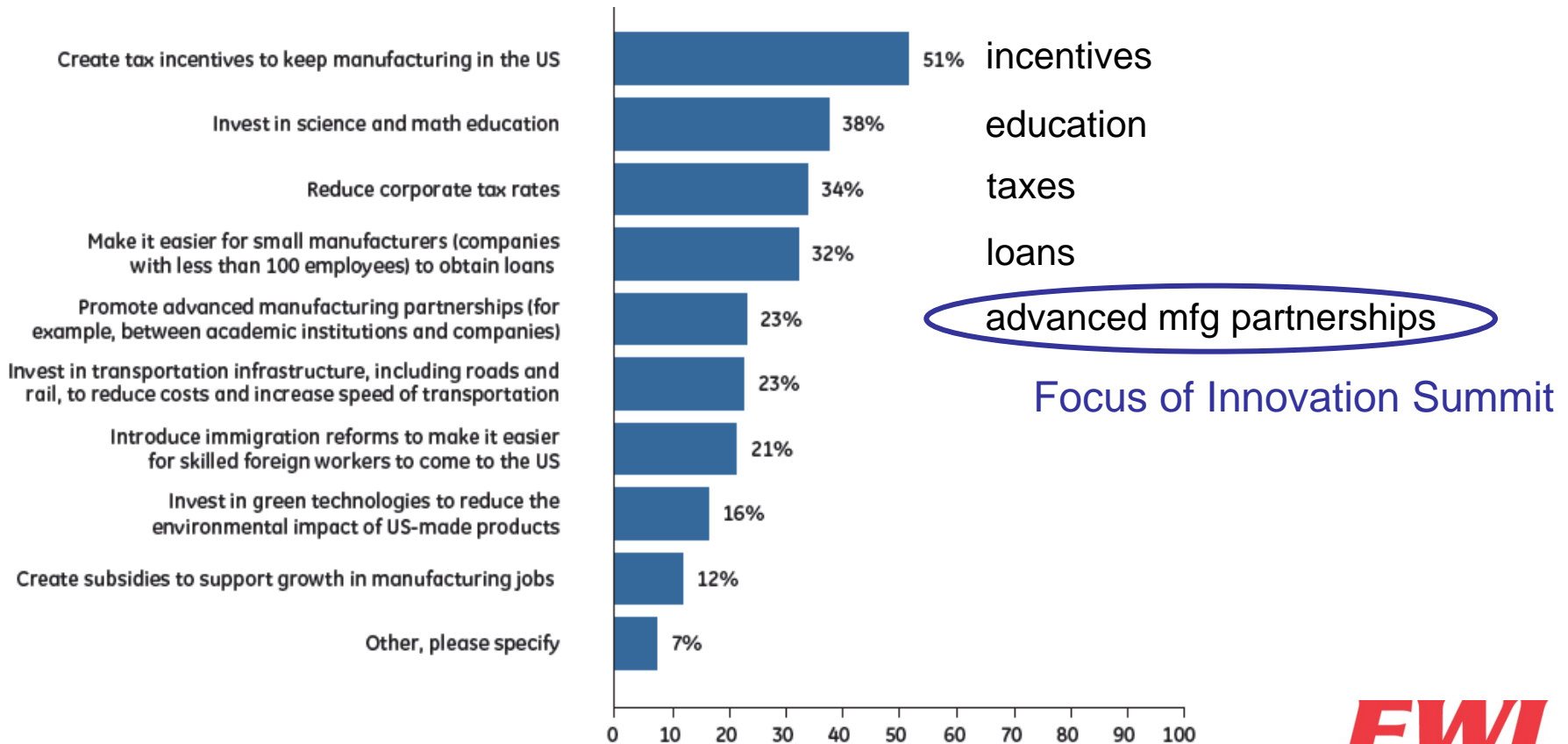
- Developed out of necessity in 1946
- Designed for agency-specific basic research at National Labs and universities
- Less than 10% of total federal funding used to transition technologies to industry

## ◆ **Other nations are...**

- Transitioning funding to development and deployment of manufacturing technology
- Incentivizing (tax breaks, capital, and bricks & mortar funds) companies to set up manufacturing facilities locally
- Surpassing the US in manufacturing

# Government's Role

What are the most important things the U.S. government can do to improve the status of the U.S. as a manufacturing destination?



Source: Economist Intelligence Unit survey, Aug. 2011

# Past Innovation Models have Strengths and Weaknesses

**The following models were evaluated:**

- ◆ **Fraunhofer Institutes (Germany)**
- ◆ **A\*STAR (Singapore)**
- ◆ **SEMATECH**
- ◆ **NIST MEPs**
- ◆ **NSF Centers**
- ◆ **EPRI**
- ◆ **EWI Edison Center**
- ◆ **DoD MANTECH**
- ◆ **Federal laboratories**
- ◆ **One-off Federal solicitations**

# Overview of “New” Model for US Manufacturing Innovation

- ◆ **Manufacturing Application Centers (cross-sector)**
  - 501(c)(3) not-for-profit, technically savvy, geographically distributed organizations
  - World-class capabilities to develop, mature, commercialize, and broadly deploy innovative manufacturing technologies
  - Capital equipment and core capabilities funded by Fed Gov’t (20% of MTAC revenue); balance funded by competitively bid programs
- ◆ **Focused Industry Consortia (sector specific)**
  - Identify key technology gaps and form project teams to develop solutions leveraging capabilities of MTACs
  - Convened by MTACs
  - Membership based, financial support from members required to demonstrate relevance of Consortia

# Synergistic Relationship Between Consortia and Application Centers

## Manufacturing Technology Applications Centers

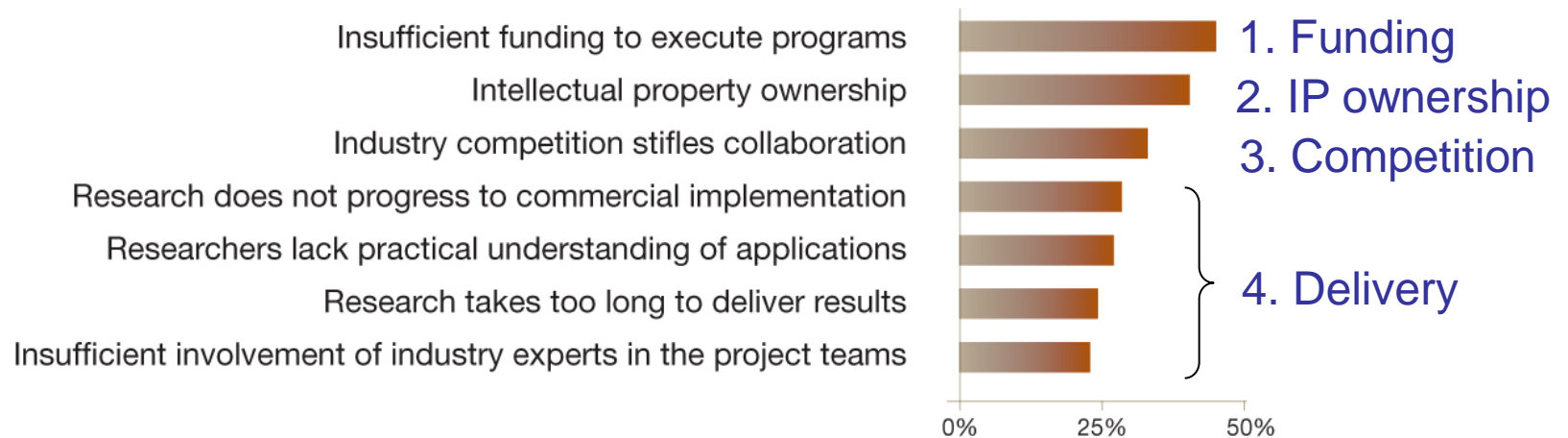
### Focused Industry Consortia

- Aerospace metal additive manufacturing
- Automotive structure light-weighting
- Battery high-speed assembly
- Electronics sustainable manufacturing
- Nuclear power equipment fabrication
- Heavy equipment manufacturing automation
- Etc...

	Automation	Casting	Electronic assembly	Forming	Inspection	Joining	Additive manufacturing	Machining	Etc...
Aerospace metal additive manufacturing	X				X	X	X	X	
Automotive structure light-weighting		X		X	X	X	X		
Battery high-speed assembly	X		X		X	X			
Electronics sustainable manufacturing	X		X			X			
Nuclear power equipment fabrication		X			X	X	X	X	
Heavy equipment manufacturing automation	X				X	X	X	X	
Etc...									

# An Effective Model Must Overcome Four Principle Challenges

*What are the biggest barriers to successful collaborative manufacturing technology development?*

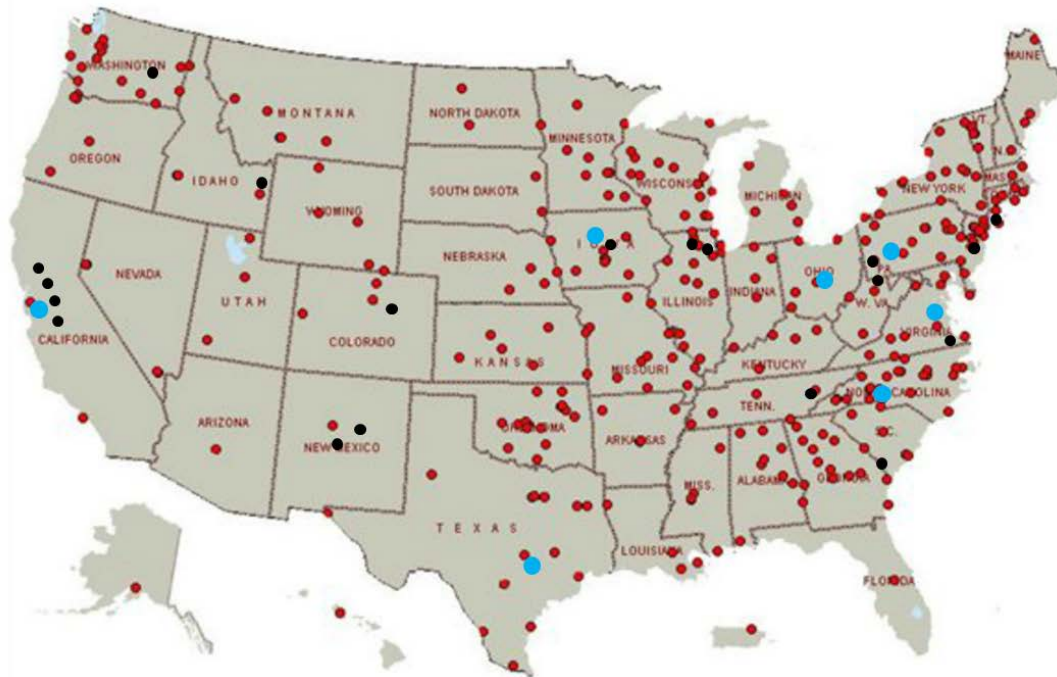


# Two Pillars of the Proposed Innovation Model

- ◆ **Manufacturing Technology Application Centers (cross-sector)**
  - Goal: develop, mature, commercialize, and broadly deploy technologies that create sustained competitive advantage
  - Funding: 20% federal funding for core capabilities; balance fee-for-service work and license revenue; independent non-profits reinvest revenue
  - IP: retained by centers with incentives to share and commercialize
  - Competition: confidential development for individual clients
  - Delivery: permanent national network to make technology widely available; serve all sectors; intermediary between universities and MEP
- ◆ **Focused Industry Consortia (sector specific)**
  - Goal: identify gaps and form project teams to develop solutions
  - Funding: government / industry balance depend on technology maturity
  - IP: accessible by consortia participants; incentives to commercialize
  - Competition: pool resources for precompetitive R&D
  - Delivery: gated programs targeting greatest needs of specific sectors

# Geographically Distributed and Linked to Existing Assets

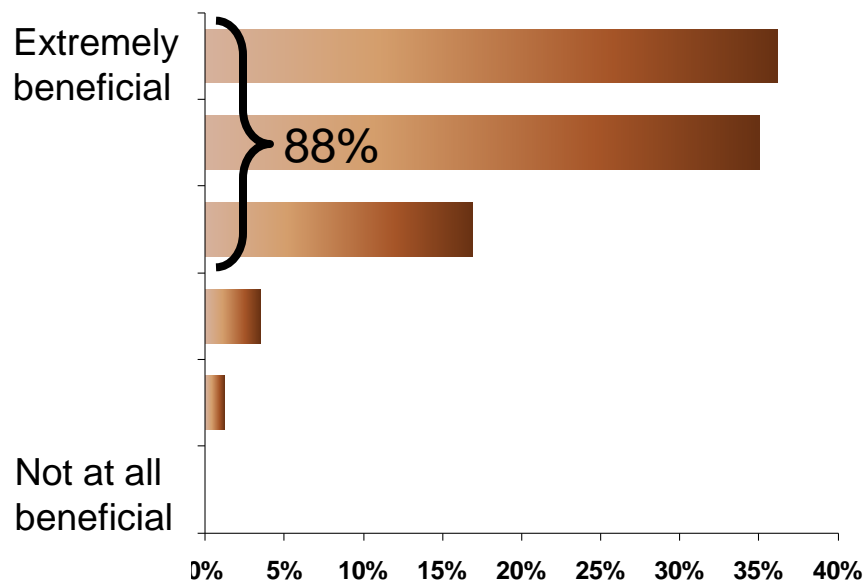
- ◆ **Locate application centers near existing basic research assets**
- ◆ **Locate consortia at centers nearest to industry clusters**
- ◆ **Linkage to existing manufacturing outreach assets**



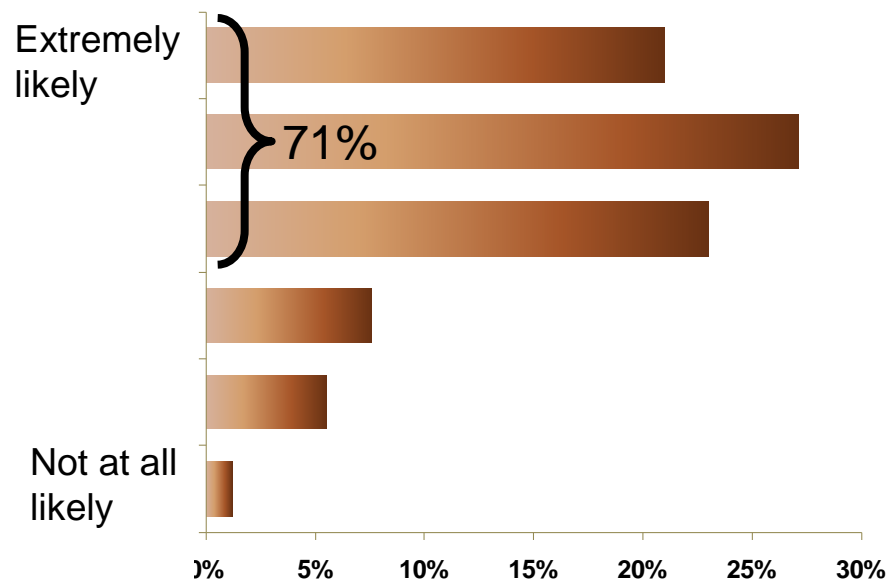
- Manufacturing extension partnership sites
- National labs
- Example application centers near related university programs or national labs

# Receptivity to the Proposed Model

Benefit of non-profit technology centers focused on manufacturing technology



Likelihood of participating in industry led consortia for manufacturing technology



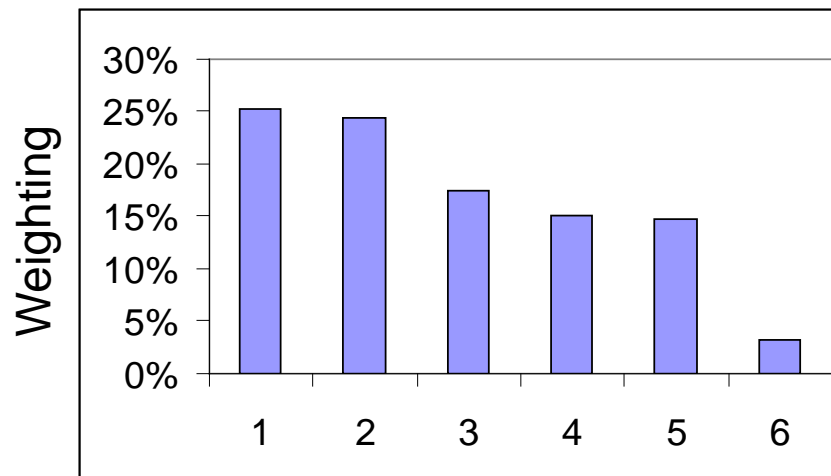
# Manufacturing Innovation Summit: Validation of Model

- ◆ **Manufacturing Innovation Summit October 27, 2011, Columbus**
- ◆ **25 industry participants**
  - Large, medium, and small companies
  - Range of sectors
- ◆ **Reviewed other innovation models**
- ◆ **Confirmed need for an infrastructure to mature manufacturing technology**
- ◆ **Consensus behind proposed framework**
- ◆ **Developed recommendations to refine and strengthen the model**



# Manufacturing Innovation Summit: Recommendations

- 1. Focus on opportunities that create sustained competitive advantage for U.S. manufacturers**
- 2. Structure to link with industry, universities, and labs**
- 3. Communicate plan to build national support**
- 4. Establish metrics to show impact**
- 5. Develop industry incentives to participate**
- 6. Articulate a workable IP strategy**



# Follow-up Activities

- ◆ **Publish Innovation Summit report**
  - ◆ **Get committed industry participants**
  - ◆ **Agency / policymaker meetings**
  - ◆ **Second Innovation Summit in DC, January timeframe**
- 
- ◆ **Let us know if you want to be involved**

“...a date that will live in infamy.”

- ◆ 70 years ago this morning, the U.S. found itself at war
- ◆ Despite the depression, “the greatest generation” rose to the occasion to simultaneously win wars in Europe and the Pacific
- ◆ Their sacrifice established America as the dominant power for over 60 years
- ◆ What will be said of our generation?





# Questions or Comments?

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# About The Manufacturing Institute

- ◆ **The Manufacturing Institute is the education and services arm of the National Association of Manufacturers;**
- ◆ **A strategic agenda to support U.S. manufacturers through education reform and workforce development, accelerating innovation, and research;**
- ◆ **Goal to build support for the creation of a network of Manufacturing Innovation Centers;**
- ◆ **Established a national system of industry-based certifications for the manufacturing workforce;**
- ◆ **Key reports include the Structural Cost Study, Skills Gap Report, and Innovation Imperative.**

# About EWI



- ◆ **An applied engineering services company that develops and commercializes advanced manufacturing technologies**
- ◆ **Broadest materials joining technical capabilities in the Western Hemisphere**
- ◆ ***Mission to advance our customers' manufacturing competitiveness through innovation in joining and allied technologies***
- ◆ **240 member companies across all manufacturing sectors**